

U.S. Geological Survey Proposal

B. Soil

Option B-1a: Monitor crop biogeochemistry

Questions:

How does the application of biosolids to agricultural soils affect crop chemistry? Are heavy metals contained in the biosolids bioavailable and thus transported into the vegetation?

Concerns:

Biosolids are known to contain elevated concentrations of certain heavy metals. The use of biosolids as a soil amendment for agricultural purposes could, in principal, cause the content of heavy metals within the soil to increase and could, if the heavy metals are bioavailable, cause crops raised on this soil to have elevated concentrations of these metals.

Objective:

To monitor the chemistry of crops grown on soils that have received biosolids for concentrations of arsenic, cadmium, copper, lead, mercury, molybdenum, nickel, selenium, and zinc.

Approach:

One "application field" will be selected for monitoring in the northern part of Metro's property and one "application field" will be selected in the southern part. The selection will be made through consultation with Metro, Arapahoe County, Elbert County, the Deer Trail Soil Conservation District, the Agate Soil Conservation District, and the Natural Resources Conservation District. Neither of the two selected "application fields" will have received biosolids application at the time of selection but will receive biosolids routinely after initial determination of baseline concentrations of elements of interest. One "control field" will be selected up-gradient from each "application field" and one down-gradient from each "application field". These four "control fields" will never receive biosolids throughout the course of the project, but will otherwise be farmed in exactly the same manner as the "application fields".

Crops (wheat?) grown in each "field" will be geochemically characterized to determine the "average" concentration of the elements of interest. The characterization will consist of collecting approximately 30 subsamples of plant material (wheat kernels?) during harvesting and compositing into one sample per "field". Each sample will be analyzed for arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, and zinc, in the USGS laboratories.

Crops will be sampled prior to biosolids application and again after each application (first post-application crop). Crops grown on the “control fields” will be sampled each time crops grown on the “application fields” are sampled. Samples will be prepared and chemically analyzed by the USGS using appropriate analytical methods and quality control protocols..

Biogeochemical data will be reviewed within one month of receipt from the laboratory and will be maintained in a USGS database. Monitoring progress and data will be released by newsletter biannually. Data will also be available in electronic format.

Data will be analyzed each year and again after about 5 years to determine how the elements of interest vary with time. Data and interpretations will be published in a report following about five years of monitoring.

Benefits:

This approach will yield high-quality data useful for determining changes, if any, in crop chemistry over time.

Limitations:

This approach provides the “average” composition of the plant material in a given field at a given time. Spatial variability of an element of interest within a given field cannot be determined by this sampling design. This approach does not allow us to distinguish different biogeochemical characteristics of crops grown on different soil types within a given “field”.